LED LIGHTING: ENERGY EFFICIENT & PLANET FRIENDLY

CREE®
LED Light

The LR4 and LR24 Story

- The Design Approach
- The Products
  - LR4
  - LR24
  - The Unique Challenges
- Examples
  - Installations
  - Economics
  - Environment
- Conclusion

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The Approach

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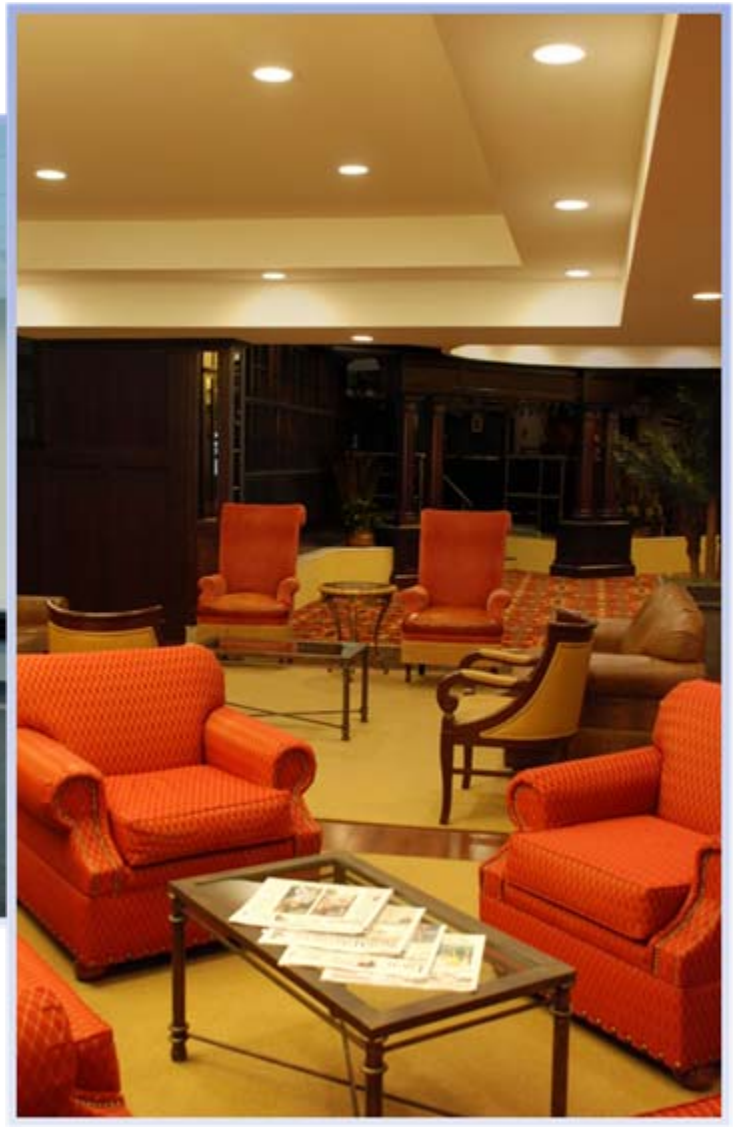
Effective LED Luminaire Design Starts Here…



LED Luminaire Design Requires a Different Approach

- It requires an integrated systems approach
  - LEDs
  - Electronics – power supply & driver
  - Mechanical design
  - Thermal management
  - Optics
- **Total system optimization is critical to maximize performance**

Cree LR6 Color Mixing Technology

- **A unique way to generate white light with LEDS**
  - **Proprietary mix of unsaturated yellow and red**
  - **Active color management**
  - **Up to 70LPW of delivered light**
  - **92+ CRI**
  - **2700K or 3500K**
- **Generate as many of the right photons as you can**

Electronics – Power Supply and Driver

- AC to DC conversion
- Power factor correction
- LED control (voltage)
  - Set initial color
  - Actively maintain color over time
  - Maintain color over range of temperatures
  - Change output based upon dimming input
- Meet FCC requirements for EMI
- Don’t waste electrons

Optical Mixing

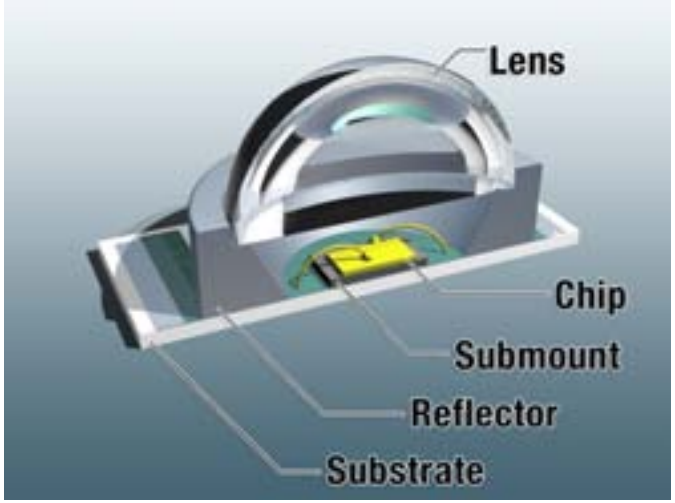
Shield LED's from direct view

Deliver homogeneous light output and appearance

Don't waste photons

LR6 Thermal Management

- Heat kills LEDs
  - Heat must be conducted away
- LED junction temperature critical to lifetime
- Thermal management is part of the system
  - From the LED chip to the environment
  - Every thermal interface must be considered and optimized
- Don’t waste LED potential



Key Question Checklist

- ❑ Energy Star Qualified?
- ❑ What are the DELIVERED lumens?
- ❑ What is the REAL Input Power?
- ❑ Do you have photometric reports and IES files?
- ❑ Have light output and color characteristics been validated by independent testing labs?
- ❑ Whose LEDs do you utilize?
- ❑ What is the CRI at each color temperature?
- ❑ How do you ensure color consistency among fixtures built today or a year from now? Over the life of a product?
- ❑ Does the thermal management system keep the LED junction temperature below specified maximums in all applications?

Lighting for Tomorrow – The Benefits

- ✓ Energy Star Qualified?
- ✓ What are the DELIVERED lumens?
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The Products

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The Products

LR4 Recessed Downlight

LR24 Architectural Lay-In

The LR4 Recessed Downlight

The LR4 Recessed Downlight

- 15 or 30 Degree Shield
- 540 or 515 Delivered Lumens
- 10.5W or 11.1W
- 2700K or 3500K CCT
- 94 or 91 CRI
- Designed for 50,000 hour L_{70}
- Dimmable to 20%
- 120V
- Power Factor > 0.95

The Unique Challenges

- LR4
  - Electronics
    - LED count
  - Optical
    - Increased Recess
    - Surface area of lens
  - Thermal
    - Deeper recess of LEDs
    - Separate trim

The LR24 Architectural Lay-in

- 2’X2’ Troffer
- 3200 Delivered Lumens
  - 40FC maintained with 8X8 spacing
- 48W Max power
- 92 CRI
- 3500K CCT
- Designed for 50,000 hour L_{70}
- Dimmable to 5%
- 120V-277V

The Unique Challenges – LR24

- Thermal
  - Operating environment
  - Height restrictions
- Electrical
  - LED count
  - Operating range
  - Dimming control

- Optical
  - LED count
  - Mechanical shielding
  - Surface area to illuminate

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The Installs

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Notre Dame Conference Room

Notre Dame Conference Room

- 3780 kWh saved annually
- 84% direct energy savings
- 4 tons of CO_2 emissions avoided annually
- 109 tons avoided over lifetime

Pentagon Wedge 5 Demonstration

Alcove Before

Pentagon Wedge 5 Demonstration

Alcove After

Pentagon Wedge 5 Renovation

Alcove Before

Alcove After

Less that 4 year payback
Over $3M Lifetime Savings
140 tons of CO_2 emissions avoided yearly

Installations – The Stanford Court

Installations

Installations

Residential Installation

Conference Room Installation

Conclusion

- **Lighting for Tomorrow has provided:**
  - **Credibility**
  - **Exposure**
  - **Motivation**

- **The LR4 and LR24 extend the application of what was learned in developing the LR6**

- **SSL luminaires are viable TODAY in numerous indoor general illumination applications**

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The End

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